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Clinical Characteristics and Procedural Outcomes of Esophageal Varices in Pediatric Patients: A Retrospective Review from a Tertiary Hospital in Saudi Arabia

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Abstract **Background:** Esophageal Varices (EV) in pediatric patients, primarily resulting from portal hypertension, pose life-threatening risks of gastrointestinal bleeding. However, pediatric-specific data remain limited, particularly in Middle Eastern settings. **Objective:** To evaluate the clinical presentations, endoscopic findings and procedural outcomes of pediatric patients diagnosed with esophageal varices at a tertiary hospital in Saudi Arabia over a ten-year period. **Methods:** This retrospective study included 22 pediatric patients (aged 0–18 years) diagnosed with esophageal varices at King Saud Medical City between March 2015 and May 2024. Medical records were reviewed for demographic, clinical and endoscopic data. Descriptive statistics were used for analysis. **Results:** Males accounted for 63.6% of the sample. The most common etiologies were portal vein thrombosis alone (27.3%) and portal vein thrombosis with hepatic fibrosis or cirrhosis (27.3%). Most patients presented with Grade II or III varices and gastric varices were observed in 45.5% of cases. Treatment modalities included band ligation (59.1%), sclerotherapy (31.8%) and injection therapy (68.2%), with 45.5% receiving combination therapy. Evidence of recent or active bleeding occurred in about one-third of patients. **Conclusion:** Pediatric esophageal varices show diverse etiologies and complex presentations, often with coexisting gastric or duodenal pathology. Early endoscopic screening, individualized treatment and long-term follow-up are essential to optimize outcomes and prevent recurrence.

Key Words Pediatric Esophageal Varices, Portal Hypertension, Gastrointestinal Bleeding, Endoscopic Treatment, Retrospective Study, Saudi Arabia

INTRODUCTION

Esophageal Varices (EV) are dilated submucosal veins in the esophagus that develop primarily due to portal hypertension and represent a major clinical concern in pediatric patients with chronic liver disease [1]. While widely studied in adults, EV in children remain underreported, especially in regions with limited access to pediatric endoscopy. The natural history and complications of portal hypertension differ significantly between children and adults, requiring specialized clinical approaches and pediatric-specific management strategies [1,2].

Pediatric patients with EV are at high risk for life-threatening upper gastrointestinal bleeding, which remains a leading cause of morbidity and mortality among children with cirrhosis or other hepatic conditions [3,4]. Despite advancements in therapeutic techniques, outcomes are often influenced by disease severity, comorbidities and timeliness of intervention, emphasizing the importance of early diagnosis and preventive management.

Upper gastrointestinal endoscopy continues to serve as the gold standard for diagnosing and managing esophageal varices, though it is invasive and requires anesthesia in children. Noninvasive approaches, such as esophageal capsule endoscopy and laboratory-based predictors, have been investigated but are not yet widely implemented in routine pediatric care due to variable accuracy and resource limitations [5].

Although this study focuses on esophageal varices, it also includes gastric and duodenal findings to provide a comprehensive assessment of portal hypertension's impact

on the upper gastrointestinal tract. These additional findings-such as gastric varices, portal hypertensive gastropathy and duodenal mucosal changes-offer valuable insights into disease severity and the distribution of venous pressure, which can influence treatment outcomes and recurrence rates.

Endoscopic therapies, particularly variceal ligation and sclerotherapy, remain the mainstay of treatment, with evidence supporting their safety and efficacy in children [6]. However, the absence of standardized pediatric protocols contributes to variation in management practices across centers.

Given the scarcity of local research and the unique clinical characteristics of pediatric patients in Saudi Arabia, this study aims to describe the etiologies, endoscopic findings and procedural outcomes of children diagnosed with esophageal varices at a tertiary care hospital. The findings are expected to inform national efforts toward developing pediatric-specific guidelines and improving care quality for children with portal hypertension.

METHODS

Research Design

This study utilized a retrospective observational design to examine the clinical characteristics and procedural outcomes of pediatric patients diagnosed with esophageal varices at King Saud Medical City Hospital in Saudi Arabia. The study covered a ten-year period, from March 2015 to May 2024 and included cases identified through the hospital's archived medical records. Retrospective studies are particularly valuable for analyzing real-world clinical data in rare conditions, allowing researchers to assess outcomes and identify patterns without interfering with patient care [7]. In this study, data were collected on demographics, clinical diagnoses, dates and types of endoscopic procedures and physicians' notes. While retrospective designs are limited by potential issues such as missing data and lack of control over confounding variables, they remain a widely accepted method for evaluating clinical trends and outcomes over extended periods [8].

Research Setting and Population

This study was conducted at King Saud Medical City Hospital, a major tertiary healthcare center located in Riyadh, Saudi Arabia. The hospital's pediatric department provides specialized care for gastrointestinal and hepatic conditions, including portal hypertension and esophageal varices. The study population included all pediatric patients aged 0 to 18 years who were diagnosed with esophageal varices and underwent endoscopic evaluation or treatment between March 2015 and May 2024. Patients with incomplete records or unclear diagnoses were excluded from the final analysis.

Research Sample

The study sample consisted of pediatric patients aged 0 to 18 years who were diagnosed with esophageal varices and received endoscopic evaluation or treatment at King Saud Medical City Hospital between March 2015 and May 2024. A total of 22 patients were included after reviewing and verifying the completeness of their medical records. Only cases with confirmed diagnoses and documented procedures were considered eligible for analysis.

Data Collection Procedure

Data were collected retrospectively from archived medical records at King Saud Medical City Hospital for pediatric patients diagnosed with esophageal varices between March 2015 and May 2024. The extracted data included patient demographics (age, sex, nationality), clinical details (diagnosis and suspected etiologies such as portal hypertension or veno-occlusive disease) and procedural information (date and type of endoscopic intervention, including EVL and sclerotherapy). Additional details such as treating physician and hospital section were also documented. All data were compiled using a standardized Excel-based abstraction sheet and patient identifiers were anonymized to ensure confidentiality and compliance with ethical standards.

Data Analysis

Data analysis was performed using Microsoft Excel for initial data cleaning and descriptive summarization. Categorical variables such as sex, nationality and diagnosis types were summarized using frequencies and percentages. Continuous variables like age were described using mean and range. Patterns related to the type and frequency of procedures (e.g., sclerotherapy, EVL) were also analyzed. Where applicable, cross-tabulations were used to explore relationships between diagnosis and procedural outcomes. Due to the retrospective and descriptive nature of the study, the analysis was primarily focused on identifying clinical trends and procedural patterns rather than hypothesis testing.

RESULTS

As shown in Table 1, the study included 22 pediatric patients categorized by age, sex and nationality. At the time of their initial visit, patients were distributed across four age groups:

- About 1–3 years (n = 5, 22.7%), 4–6 years (n = 5, 22.7%), 7–9 years (n = 4, 18.2%) and 10–13 years (n = 8, 36.4%)
- In terms of sex, a greater proportion of the patients were male (n = 14, 63.6%) compared to female (n = 8, 36.4%)
- With regard to nationality, the largest group was Saudi (n = 13, 59.1%), followed by Yemeni (n = 4, 18.2%)
- Other nationalities included Sudanese (n = 2, 9.1%), Syrian (n = 2, 9.1%), Jordanian (n = 1, 4.5%) and Indian (n = 1, 4.5%)

The underlying etiologies of esophageal varices among the 22 pediatric patients demonstrated notable diversity. Portal Vein Thrombosis (PVT) without accompanying hepatic fibrosis or cirrhosis was the most frequently observed cause, accounting for 27.3% (n = 6) of cases. An equal proportion (27.3%, n = 6) of patients exhibited PVT in conjunction with hepatic fibrosis or cirrhosis, including cases with cavernous transformation of the portal vein.

Table 1: Baseline Socio-Demographic Characteristics of the Enrolled Pediatric Patients

Variable	Frequency (F)	Percentage
Age Group (at initial visit)		
1–3 years	5	22.7
4–6 years	5	22.7
7–9 years	4	18.2
10–13 years	8	36.4
Sex		
Male	14	63.6%
Female	8	36.4
Nationality		
Saudi	13	59.1
Yemeni	4	18.2
Sudanese	2	9.1
Syrian	2	9.1
Jordanian	1	4.5
Indian	1	4.5

Table 2: Underlying Etiologies of Esophageal Varices among Pediatric Patients (n = 22)

Etiology Category	Description/Examples	Frequency (n)	%
Portal Vein Thrombosis (PVT) only	PVT with normal liver function or unspecified status	6	27.3
PVT with hepatic fibrosis or cirrhosis	PVT with cavernous transformation, hepatic fibrosis, or confirmed cirrhosis	6	27.3
Genetic/Metabolic Syndromes	WDR35 gene mutation with ESRD and hepatic fibrosis, ARPKD, Caroli disease	2	9.1
Prematurity-related with PVT	Preterm infants with CP or NICU stay and later development of PVT	2	9.1
Hemoglobinopathies (Sickle Cell Anemia)	Known SCA with cirrhosis and portal hypertension secondary to PVT	2	9.1
Portal Hypertension ± Splenomegaly (non-specific/idiopathic)	Portal hypertension ± splenomegaly without clear cirrhosis or thrombosis classification	2	9.1
Cirrhosis without clear PVT mention	Liver cirrhosis + portal hypertension, no thrombosis mentioned	2	9.1
Total		22	100

Genetic or metabolic syndromes, such as WDR35 gene mutations Associated with End-Stage Renal Disease (ESRD), autosomal recessive Polycystic Kidney Disease (ARPKD) and Caroli disease, were identified in 9.1% (n = 2) of patients. Similarly, prematurity-related complications accompanied by PVT were observed in 9.1% (n = 2) of cases. Another 9.1% (n = 2) of patients had a documented history of Sickle Cell Anemia (SCA) with cirrhosis and portal hypertension secondary to PVT (Table 2). Idiopathic or non-specific portal hypertension with or without splenomegaly, lacking definitive evidence of thrombosis or cirrhosis, was also noted in 9.1% (n = 2) of the cohort. Finally, cirrhosis in the absence of a clearly documented PVT was reported in 9.1% (n = 2) of patients.

Table 3: Grades of Esophageal Varices (First Encounter per Patient)

Grade of Esophageal Varices	Frequency	(%)
Grade I	6	27.3
Grade II	6	27.3
Grade III	7	31.8
Grade IV	1	4.5
Grade II–III*	2	9.1
Total	22	100

*For patients with mixed grades (e.g., Grade II–III), the mixed category is preserved unless clearly dominated by one

Table 4: Clinical and Endoscopic Characteristics of the Enrolled Pediatric Patients

Finding	Frequency (n)	Percentage
Gastric Varices	10	45.5
Fundal Varices	3	13.6
GOV1 (Lesser curvature extension)	6	27.3
GOV2 (Fundus extension)	7	31.8
Portal Hypertensive Gastropathy	10	45.5
Gastritis/Erythematous Mucosa	12	54.5
Duodenal Polyps	2	9.1
Duodenitis	2	9.1
Duodenal Ulcers (Forrest IIb/III)	2	9.1
Hiatal Hernia	1	4.5
Food Residue in Stomach	8	36.4
Fistula/Mucosal Abnormalities	2	9.1
Previous Surgery Evidence	1	4.5

Table 5: Gastric and Duodenal Mucosal Findings

Mucosal Finding*	Frequency**	Percentage
Erythematous gastric mucosa***	11	50.0
Food residue in the stomach	8	36.4
Normal stomach	12	54.5
Gastritis (including portal or watermelon gastritis)***	4	18.2
Portal Hypertensive Gastropathy (PHG)	7	31.8
Duodenal polyps	2	9.1
Duodenitis	2	9.1
Normal duodenum	16	72.7
Duodenal ulcer (clean base or clot)	2	9.1
Erythematous duodenopathy	1	4.5

*Some patients had multiple mucosal findings in the same or different sessions. **Frequencies are per patient, not per session. *** "Erythematous gastric mucosa" refers to mild mucosal redness or irritation observed endoscopically, whereas "gastritis" denotes more significant inflammation diagnosed endoscopically or histologically. Some patients may exhibit both findings during different sessions, reflecting disease variability

As summarized in Table 3, the grades of Esophageal Varices (OV) documented at the first endoscopic evaluation varied among the 22 pediatric patients. Grade III was the most frequently observed, occurring in 7 patients (31.8%). Both Grade I and Grade II were each reported in 6 patients (27.3%). A single patient (4.5%) had Grade IV varices. Additionally, 2 patients (9.1%) presented with mixed grades categorized as Grade II-III at their initial endoscopic examination.

As detailed in Table 4, the most commonly observed endoscopic findings among the pediatric patients included gastritis or erythematous mucosa (54.5%) and portal hypertensive gastropathy (45.5%). Gastric varices were also noted in 10 patients (45.5%), while gastric extension patterns of esophageal varices were categorized as GOV1 in 6 patients (27.3%) and GOV2 in 7 patients (31.8%). Fundal varices were identified in 3 patients (13.6%).

Table 6: Types of Gastroesophageal and Gastric Varices (Per Patient)

Variceal Type	Frequency	%
Esophageal Varices only	22	100.0
Gastroesophageal Varices Type 1 (GOV1)	5	22.7
Gastroesophageal Varices Type 2 (GOV2)	7	31.8
Gastric Varices (isolated or extension of esophageal)	6	27.3
Fundal Varices	3	13.6

Other less frequent but notable findings included the presence of food residue in the stomach (36.4%), duodenal polyps (9.1%), duodenitis (9.1%) and duodenal ulcers classified as Forrest IIb or III (9.1%). Rare findings included hiatal hernia (4.5%), fistulas or mucosal abnormalities in the esophagus (9.1%) and evidence of previous surgery (4.5%).

As presented in Table 5, the most frequent gastric mucosal finding was erythematous gastric mucosa, observed in 50% of the pediatric patients, followed by food residue in the stomach (36.4%). Despite these abnormalities, more than half of the patients (54.5%) exhibited a normal stomach on at least one encounter. Gastritis-including portal hypertensive and watermelon gastritis-was documented in 18.2% of patients.

Regarding duodenal mucosa, the majority (72.7%) showed a normal duodenum. Duodenal abnormalities included polyps and duodenitis, each reported in 9.1% of patients, while duodenal ulcers (classified as clean base or with clot) were also noted in 9.1%. A small proportion of patients (4.5%) exhibited erythematous duodenopathy.

As shown in Table 6, all enrolled pediatric patients (100%) presented with Esophageal Varices (OV) during their initial or subsequent endoscopic evaluations. Gastroesophageal varices were also common, with type 1 (GOV1), which extends along the lesser curvature, observed in 22.7% of patients and type 2 (GOV2), which extends into the fundus, documented in 31.8%.

In addition to these, 27.3% of patients had gastric varices-either as an isolated finding or as an extension of esophageal varices-highlighting the complexity of portal hypertension-related pathology in this population. Fundal varices, a more specific subset of gastric varices, were noted in 13.6% of patients.

As illustrated in Table 7, various endoscopic treatment modalities were employed among the enrolled pediatric patients, often in combination. Injection therapy (e.g., non-sclerosing agents such as Glubran) was the most frequently used intervention, applied in 68.2% of the patients. Band ligation was the second most common, used in 59.1% of the cases, followed by sclerotherapy in 31.8%.

Notably, 45.5% of patients received both banding and injection as part of their treatment regimen, reflecting a multimodal approach to managing complex variceal presentations. In contrast, 9.1% of patients did not undergo any documented endoscopic intervention, possibly due to clinical considerations or early-stage findings not warranting immediate treatment.

As shown in Table 8, clinical or endoscopic evidence of bleeding was present in 22.7% of the enrolled pediatric patients, whereas the majority (77.3%) had no signs of active bleeding at the time of their initial or subsequent evaluations.

Table 7: Treatment Modalities Used Among the Enrolled Pediatric Patients

Treatment Modality	Frequency	%
Band Ligation	13	59.1
Sclerotherapy	7	31.8
Injection (non-sclero, e.g., Glubran)	15	68.2
Both Banding and Injection	10	45.5
No Intervention Noted	2	9.1

Table 8: Presence of Bleeding and Stigmata of Recent Bleeding

Finding	Frequency (n)	%
Bleeding present	5	22.7
Bleeding absent	17	77.3
Stigmata of recent bleeding present	7	31.8
Stigmata of recent bleeding absent	15	68.2

Stigmata of recent bleeding, such as red wale signs or adherent clots, were observed in 31.8% of the patients. In contrast, 68.2% showed no such stigmata during endoscopic examination.

DISCUSSION

This study provides a detailed retrospective analysis of pediatric patients diagnosed with esophageal and gastric varices secondary to portal hypertension. The findings reveal a diverse clinical presentation among children, with varying endoscopic grades of varices and associated gastrointestinal findings.

The variation in age and clinical course suggests that pediatric portal hypertension is a heterogeneous condition, often presenting with multiple gastrointestinal complications, necessitating individualized and multidisciplinary management approaches. Prior studies have also emphasized that pediatric varices, unlike those in adults, require nuanced evaluation and longitudinal monitoring due to their dynamic nature [5,9].

The analysis of underlying etiologies revealed that Portal Vein Thrombosis (PVT), either alone or in combination with hepatic fibrosis or cirrhosis, accounted for the majority of cases (54.6%). This aligns with previous studies indicating that PVT is a predominant driver of esophageal varices in pediatric populations, especially in regions where extrahepatic portal vein obstruction is prevalent [3,10].

Notably, a subset of patients exhibited varices secondary to genetic or metabolic disorders such as WDR35 gene mutations, ARPKD and Caroli disease, underscoring the importance of considering syndromic associations in younger children. Prematurity-related complications and hemoglobinopathies like sickle cell anemia also emerged as contributing factors, highlighting the diverse and multifactorial nature of variceal formation in pediatric patients. These findings emphasize the need for tailored diagnostic algorithms and individualized treatment planning that account for the underlying etiology, especially in tertiary care settings managing complex pediatric liver disease.

The grades of esophageal varices observed in this population ranged from mild to severe, including mixed presentations. This variation reflects the progressive nature of portal hypertension in pediatric patients and reinforces

the importance of regular endoscopic surveillance. Similar patterns have been documented in the literature, where a subset of children experiences rapid variceal progression, especially those with underlying liver disease or congenital anomalies affecting portal circulation [3,10]. In children, the onset and evolution of varices can be unpredictable, underscoring the value of early identification and prophylactic interventions.

In addition to esophageal involvement, a significant proportion of patients demonstrated gastric varices, gastropathy and mucosal changes in the stomach and duodenum. These findings highlight the systemic effects of portal hypertension and its impact on the entire upper gastrointestinal tract.

The co-existence of portal hypertensive gastropathy and erythematous gastric mucosa has been previously reported as common in children with chronic liver disease, contributing to the overall burden of disease [4,11]. The presence of these mucosal abnormalities may also increase the risk of bleeding and complicate endoscopic procedures.

Therapeutic interventions varied across the cohort, including band ligation, sclerotherapy and endoscopic injections. A combination of modalities was often employed to manage recurrent or severe cases. These findings align with previous studies which suggest that a tailored therapeutic strategy is often required in pediatric patients to achieve effective hemostasis and prevent recurrence [6]. In contrast to adult guidelines, pediatric endoscopic therapy lacks standardized protocols, which may explain the variability in clinical decision-making observed in this study. This variation reflects the ongoing debate in pediatric hepatology regarding the optimal timing and type of intervention for variceal bleeding [8].

Among the patients studied, episodes of gastrointestinal bleeding and evidence of stigmata of recent bleeding were notable. These clinical events underscore the need for early intervention and vigilant follow-up. Bleeding from varices remains one of the most serious complications of pediatric portal hypertension, often requiring urgent endoscopic or surgical management [3,4]. Early endoscopic identification of stigmata has been associated with improved outcomes, as it allows clinicians to proactively address potential bleeding sources before clinical deterioration occurs.

The study also revealed the presence of complex variceal patterns, including gastroesophageal and isolated gastric varices. These findings are particularly relevant as such patterns may be associated with different bleeding risks and may not respond uniformly to standard interventions. Prior literature has highlighted that gastric and fundal varices are typically more challenging to treat and may require more aggressive or repeated endoscopic sessions [1,6]. The inclusion of these cases in the present study adds to the understanding of the clinical spectrum of pediatric variceal disease.

The importance of mucosal findings such as erythema, gastropathy and duodenal pathology cannot be overstated. These changes, although often subclinical, may influence decisions regarding surveillance intervals, medical therapy and timing of interventions. The presence of food residue, fragile mucosa, or inflammation may obscure visualization during endoscopy and increase the procedural risks. As noted in previous studies, attention to these findings improves the overall safety and efficacy of endoscopic evaluations in children [11,12].

The findings of this study are consistent with reports from other Middle Eastern populations, where portal vein thrombosis and hepatic fibrosis remain leading causes of pediatric esophageal varices. Studies from Egypt and the Gulf region have similarly highlighted extrahepatic portal vein obstruction as a predominant etiology, accounting for more than half of pediatric cases [11,13]. Moreover, the observed rates of gastric and portal hypertensive gastropathy align with regional data showing frequent coexistence of gastric mucosal changes in children with advanced portal hypertension. These parallels suggest that the underlying disease mechanisms and healthcare challenges in Saudi Arabia mirror those seen in neighboring countries, underscoring the need for unified regional protocols for early screening and intervention.

A notable limitation of this study lies in its retrospective design, which inherently limits causal inference and may introduce selection and documentation biases. Data availability was restricted to what was recorded during clinical care, potentially omitting relevant variables such as laboratory findings or hemodynamic parameters. Furthermore, the use of descriptive data from a single center may limit the generalizability of findings to other pediatric populations. Nonetheless, retrospective studies remain valuable in rare pediatric conditions, offering insight into real-world practice patterns and informing future prospective research [7,8]. In addition, this study relied exclusively on descriptive statistical analysis due to the relatively small sample size and retrospective nature of the data. While this approach provides a clear overview of clinical and procedural patterns, it limits the ability to perform inferential or multivariate analyses that could establish statistically significant associations or predictive factors. Therefore, the findings should be interpreted with caution and future multicenter studies with larger cohorts are recommended to validate and expand upon these results.

CONCLUSION

In conclusion, this retrospective analysis highlights the diverse clinical manifestations and endoscopic findings associated with esophageal and gastric varices in pediatric patients with portal hypertension. The variability in variceal grades, mucosal involvement and treatment modalities underscores the complexity of managing such cases in children. Timely diagnosis, individualized therapeutic strategies and regular surveillance are essential to prevent complications such as bleeding. In addition to these findings, establishing regional registries and multicenter collaborations across Saudi Arabia and neighboring countries is strongly recommended. Such initiatives would enhance data sharing, improve the understanding of pediatric portal hypertension and support the development of unified, evidence-based clinical guidelines tailored to the regional population.

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